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ASSESSING THE IMPLICATIONS OF CLIMATE CHANGE IN ARMENIA: CHALLENGES, OPPORTUNITIES, AND POLICY RESPONSES

Armenia, located in the South Caucasus, confronts significant challenges posed by climate change, including rising temperatures, altered precipitation patterns, and increased frequency of extreme weather events. However, amidst these challenges lie opportunities for proactive adaptation and mitigation efforts. Renewable energy development, ecosystem restoration, climate-smart agriculture, efficient water resource management, climate-resilient infrastructure, community engagement, capacity building, and international collaboration present avenues for addressing climate change impacts effectively. By capitalizing on these opportunities and implementing targeted policy responses, Armenia can enhance its resilience, promote sustainable development, and mitigate the adverse effects of climate change. This paper assesses the implications of climate change in Armenia, delineates key challenges and opportunities, and outlines policy responses aimed at fostering climate resilience and sustainability.

Keywords: *Armenia, climate change, greenhouse gas emissions, adaptation, mitigation, vulnerability, policy responses*

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INTRODUCTION: Armenia, situated in the South Caucasus region, faces significant challenges stemming from climate change, despite its relatively minor contribution to global greenhouse gas emissions. Over the past century, Armenia has experienced a notable rise in average temperatures, leading to the degradation of critical landscapes such as watersheds and wetlands. With a high dependency on agriculture and a large rural population, the country is particularly vulnerable to climate-related risks, including droughts, soil erosion, and natural hazards. Recognizing these challenges, Armenia has embarked on an ambitious journey to adapt to climate change and reduce domestic greenhouse gas emissions. Through strategic policy interventions and integration of climate considerations into national development agendas, Armenia aims to enhance its resilience to climate impacts while transitioning towards a low-carbon economy. This paper provides a comprehensive analysis of Armenia's climate vulnerabilities, greenhouse gas emissions profile, adaptation measures, and policy responses, highlighting the country's proactive stance in addressing the pressing issues posed by climate change.

LITERATURE REVIEW: The economic implications of climate change in Armenia have garnered increasing attention in academic research and policy discourse. Scholars and relevant international organizations have explored various facets of this complex issue, ranging from sector-specific vulnerabilities to broader strategies for adaptation and mitigation. This literature review synthesizes key findings and insights from relevant studies, providing a comprehensive understanding of the challenges, opportunities, and policy responses associated with climate change in Armenia.

As climate change continues to pose challenges, countries with renewable or green energy production must consider restructuring their economic models to secure future economic development. Despite the significant progress made over the past three decades—a period marked by substantial advancements in human history—the impacts of climate change are increasingly influencing the global economic framework. Consequently, these impacts necessitate the formation of a new and critical perspective for reassessing economic development indicators. This perspective should serve as the foundation for crafting effective and focused policies¹.

The OECD Secretariat conducted a comprehensive assessment to estimate the investment needs for climate action in Armenia, aiming to inform policy discussions and mobilize finance in alignment with the country's national targets, including those outlined in its Intended Nationally Determined Contribution (INDC) to the UNFCCC. Drawing on inputs from Armenian ministries, public and private sector entities, development partners, and civil society organizations, the report identifies approximately 50 climate-related actions with indicative investment costs. The assessment reveals that significant investments, totaling at least USD 5.7 billion (AMD 2.7 trillion) by 2030, are required for Armenia to achieve its climate and energy objectives. This figure increases to USD 8.3 billion (AMD 4 trillion) if

¹ **Vardanyan T.**, “Global Economy: A Cause of Climate Change or Solution?” AMBERD Bulletin, 2023, 1 (20), p. 104-110, (Arm) Available at: <https://asue.am/upload/files/amberd/2023-year-1/11.pdf>

investments in nuclear energy proceed as planned. With Armenia's GDP projected to reach nearly USD 13 billion in 2021 and USD 19 billion in 2025, the estimated investment translates to annual expenditures of 4–6% of GDP over the next seven years². Urgency is emphasized in sourcing and allocating financial resources, necessitating close cooperation among stakeholders spanning government ministries, the private sector, civil society, and international partners.

The WBG's Action Plan on Adaptation and Resilience (2019)³ emphasizes the systematic incorporation of climate risks and opportunities throughout all stages of policy planning, investment design, implementation, and evaluation of development outcomes. Drawing on data from the WBG's Climate Change Knowledge Portal, this tool enables comprehensive assessment of short- and long-term climate and disaster risks.

Similarly, ADB's Strategy 2030 identifies climate change mitigation and adaptation as a key operational priority, necessitating the mainstreaming of climate considerations into corporate strategies, sectoral plans, and project design and implementation processes. ADB's climate risk management framework mandates climate risk screening for all projects and comprehensive assessments for those deemed to have medium to high risk⁴.

To support their shared client countries, the WBG's Climate Change Group and ADB's Sustainable Development and Climate Change Department collaborated on a "Climate Risk Country Profile: Armenia"⁵. This document provides a concise overview of the climate risks facing Armenia, drawing on existing research and analyses. It highlights both rapid onset and long-term changes in climate parameters and their impacts on communities, livelihoods, and economies.

The heightened temperatures, coupled with increased drought risk, pose a significant threat to rural communities reliant on subsistence agriculture, exacerbating existing vulnerabilities. Furthermore, the anticipated disappearance of the Caucasus Glaciers over the century will intensify pressure on water management infrastructure, aggravating challenges related to water scarcity and distribution. The changing climate is expected to drive notable shifts in ecosystem composition, including dryland expansion, forest loss, and species range shifts. This, in turn, will impact biodiversity and ecosystem services, necessitating adaptive management strategies. The heightened risk of both floods and landslides underscores the importance of disaster risk reduction efforts, particularly in

² OECD, "AN ASSESSMENT OF INVESTMENT NEEDS FOR CLIMATE ACTION IN ARMENIA UP TO 2030", p. 17, available at: <https://www.eu4environment.org/app/uploads/2021/04/Report-Assessment-of-Investment-Needs-for-Climate-Action-in-Armenia-up-to-2030.pdf>

³ The World Bank Group "The World Bank Group's Action Plan on Climate Change Adaptation and Resilience. Managing Risks for a More Resilient Future", available at: <https://documents1.worldbank.org/curated/en/519821547481031999/The-World-Bank-Groups-Action-Plan-on-Climate-Change-Adaptation-and-Resilience-Managing-Risks-for-a-More-Resilient-Future.pdf>

⁴ Asian Development Bank "Strategy Achieving a Prosperous, Inclusive, Resilient, and Sustainable Asia and the Pacific", 2018, available at: <https://www.adb.org/sites/default/files/institutional-document/435391/strategy-2030-main-document.pdf>

⁵ The World Bank Group and the Asian Development Bank "Climate Risk Country Profile: Armenia", 2021, available at: https://climateknowledgeportal.worldbank.org/sites/default/files/2021-06/15765-WB_Armenia%20Country%20Profile-WEB_0.pdf

vulnerable rural areas. Additionally, reductions in arable land and crop yields threaten food production and food security goals, hindering efforts to combat undernourishment in Armenia⁶.

The research conducted by the International Monetary Fund (IMF) in Armenia, entitled "Quantifying Fiscal Risks from Climate Change," offers valuable insights into the long-term impacts of climate change on the country's economy and public finances. Using an empirical approach, the study provides guidance on quantifying these risks, focusing on the potential effects of various temperature scenarios on GDP and government finances. The findings highlight the severe economic consequences of extreme unmitigated temperature scenarios, which could lead to an 18% reduction in GDP relative to the baseline. Moreover, such scenarios could result in an unsustainable trajectory for public debt by the year 2070. This underscores the urgent need for proactive measures to mitigate climate risks and safeguard fiscal sustainability. The study also identifies specific vulnerabilities within Armenia's state balance sheet, particularly in state-owned enterprises (SOEs), public-private partnerships (PPPs), and lending portfolios in key sectors such as energy, water, and transport. These sectors are particularly exposed to the impacts of climate change, further emphasizing the importance of integrating climate considerations into fiscal and economic planning processes⁷.

If strong and immediate actions are not taken, we may face increasingly severe economic and environmental consequences requiring a more comprehensive set of laws and actions. The current policies, while crucial, may need to be enhanced and expanded to effectively confront the significant challenges ahead. This underscores the critical need for ongoing research, innovative policy initiatives, and global commitment to address the complex and interconnected issues posed by climate change⁸.

The literature review synthesizes key findings regarding the impacts of climate change on Armenia's economy and fiscal sustainability. Projections suggest significant warming trends, posing threats to human health, ecosystems, and food security. The IMF's research underscores the potential for extreme unmitigated temperature scenarios to significantly reduce GDP and lead to unsustainable public debt trajectories. Additionally, vulnerabilities in state-owned enterprises and key sectors like energy, water, and transport highlight the urgent need for coordinated action to mitigate climate risks and build resilience. Overall, these studies emphasize the imperative of integrating climate considerations into development agendas and fiscal planning processes to ensure Armenia's long-term sustainability and prosperity.

⁶ The World Bank Group and the Asian Development Bank "Climate Risk Country Profile: Armenia", 2021, p. 2, available at: https://climateknowledgeportal.worldbank.org/sites/default/files/2021-06/15765-WB_Armenia%20Country%20Profile-WEB_0.pdf

⁷ The International Monetary Fund "Quantifying Fiscal Risks from Climate Change," available at: <https://www.elibrary.imf.org/view/journals/002/2022/329/article-A001-en.xml>

⁸ Mikayelyan V., Vardanyan T., "Navigating Climate's Impact on the World Economy", *Economy and Society*, 2023, ASUE, Tntesaget, 3(3), p. 173-191 available at: <https://asue.am/upload/files/science/economy/2023-year-3/9.pdf>

Research methodology: The theoretical and methodological framework of this paper draws from a wide array of international economists and researchers, encompassing classical and contemporary economic theories relevant to understanding the intricate relationship between climate change and Armenia's economy. Additionally, insights are derived from reports and strategic programs of governmental bodies, as well as reports from both state and private organizations within Armenia such as Statistical Committee of the Republic of Armenia. Key sources of data include publications from authoritative international organizations such as the World Bank, UN, International Energy Agency, and relevant local institutions. Data on Armenia's historical temperature and CO₂ emissions were collected from the National Aeronautics and Space Administration (NASA) and The World Bank's climate data portals.

Quantitative methods serve as the backbone for statistical analyses, providing answers to critical research inquiries. The primary situational analysis relies on quantitative approaches, utilizing statistical tools to analyze datasets from reputable sources. This includes an examination of trends in climate indicators and economic performance. Specific quantitative tools employed include trend analysis, growth rates calculation, and comparative assessments.

Complementing the quantitative analyses, qualitative methods offer depth to the understanding of the multifaceted impact of climate change on Armenia's economy. Observations and content analysis are instrumental in exploring nuanced aspects, such as stakeholder perspectives and the role of climate policies. The qualitative approach involves an in-depth examination of case studies and expert insights to complement the quantitative findings. We employed trend analysis to examine the changes in Armenia's average temperatures over the decades, as shown in Figure 2, which illustrates the rising trend in both global and local temperature scales. Growth rates were calculated to assess the increase in CO₂ emissions from Armenia over the period from 1990 to 2020, detailed in the Results section, Table 1. Comparative assessments were utilized to evaluate Armenia's climate policy effectiveness against its projected impacts on greenhouse gas emissions, as discussed in the Policy Responses section.

In terms of economic theory, this study adopts a historical-deductive method to comprehensively understand the interplay between climate change and Armenia's economy. This method involves examining historical data and events to derive insights into the causal relationships between climate change and economic phenomena, allowing for a nuanced understanding of how past events have shaped current economic dynamics in Armenia.

While the historical-deductive method forms the primary approach, elements of the hypothetical-deductive method are also incorporated to strengthen the analytical framework. This method enables the derivation of mathematically rigorous theories from foundational assumptions, ensuring a balanced approach that acknowledges both theoretical rigor and practical relevance.

In summary, this paper employs a dual-pronged research methodology, integrating quantitative and qualitative approaches, as well as historical-deductive and hypothetical-deductive methods. This multifaceted approach aims to provide a comprehensive and nuanced examination of the economic implications of climate change in Armenia, addressing the need for clarity in both qualitative and quantitative tools and explicitly defining the research goal.

Analysis: In accordance with the guidelines of the United Nations Framework Convention on Climate Change (UNFCCC), countries are actively developing national emissions inventories and implementing mitigation actions. However, CO₂ emissions, the primary contributors to global GHG emissions, continue to rise globally despite international climate agreements. To address this challenge, the Emissions Database for Global Atmospheric Research (EDGAR) offers an independent estimate of GHG emissions for each country. Utilizing a robust methodology aligned with the latest IPCC guidelines and incorporating recent activity data, EDGAR provides comprehensive greenhouse gas emission data spanning from 1970 to 2022 for all IPCC sectors in each country. According to data from the World Bank, CO₂ emissions in Armenia averaged 5713.2 kilotons (kt) for the years 1990-2020. Notably, in 2020, emissions were approximately three times lower compared to 1990, amounting to 6746.6 kt. According to the Statistical Committee of the Republic of Armenia, the emissions of hazardous substances into the atmosphere totaled 317.4 thousand tonnes, representing an increase of more than 17% compared to the year 2018⁹.

The energy sector, including transportation, accounts for the vast majority of carbon dioxide emissions in Armenia, comprising 94.9% of the total. This is primarily due to significant emissions from thermal power plants, motor transport, and the residential sector. Emissions from the industrial processes and product use (IPPU) sector contribute approximately 5.0% to the total carbon dioxide emissions. Conversely, emissions from the waste sector are negligible in comparison. Methane emissions in Armenia are predominantly attributed to the energy sector, accounting for 44.6% of total emissions, primarily stemming from fugitive emissions within the natural gas system. The agriculture sector is the second-largest source, contributing 35.0% of methane emissions, primarily generated by cattle enteric fermentation. Additionally, the waste sector accounts for 20.4% of methane emissions¹⁰. The majority of nitrous oxide emissions, constituting 91% of the total, originate from the agriculture sector. These emissions are primarily a result of nitrogen fertilizer management practices and direct and indirect emissions from managed soils. Furthermore, emissions from hydrofluorocarbons (HFCs), derived from the use of refrigerators, air conditioners, and other appliances, along with sulfur hexafluoride emissions from electrical equipment, are steadily increasing over time.

It is important to recognize that Armenia's contribution to the global climate system is minimal, with the country accounting for an average of 0.022% of global emissions during the specified period. Despite its relatively small contribution to global greenhouse gas emissions, Armenia is considered vulnerable to the impacts of climate change. The rate of temperature increase in Armenia exceeds the global average, making the country susceptible to various climate-related challenges and risks. From 1990 to 2022, the average air temperature in Armenia was 7.78 degrees Celsius. Over this period, there has been a notable increase in temperature, with the index rising by 1.36 degrees Celsius compared to 1990. In

⁹ The Statistical Committee of the Republic of Armenia, Statistical Yearbook of Armenia, 2023, Environment and Natural Resources, available at: <https://armstat.am/file/doc/99541088.pdf>

¹⁰ The World Bank's Climate Change Knowledge Portal: <https://climateknowledgeportal.worldbank.org/country/armenia>

2022, the average air temperature reached 8.64 degrees Celsius, reflecting a warming trend over the past few decades¹¹.

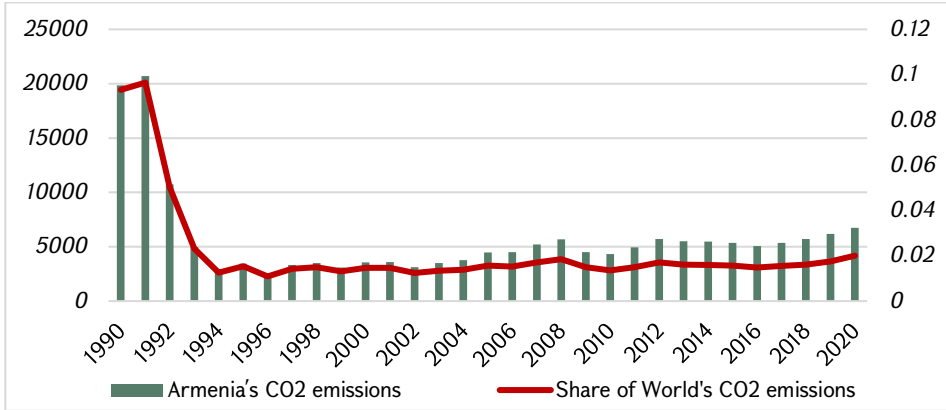


Figure 1. Armenia's CO₂ emissions (kt) and share of World's CO₂ emissions (%)¹²

Armenia, situated in the South Caucasus region, is a mountainous, landlocked country that stands out as one of the most vulnerable nations in Europe and Central Asia to the impacts of climate change. Armenia's climate can be characterized as highland continental, featuring significant variations between summer highs (June to August) and winter lows (December to February). The country's diverse terrain contributes to large climatic disparities, ranging from arid to sub-tropical to cold, high mountain climates. In the capital city of Yerevan, average summer highs range from 30°C to 33°C, while winter averages fall between 1°C and 3°C. Mountainous regions generally experience lower average temperatures and prolonged snow cover.

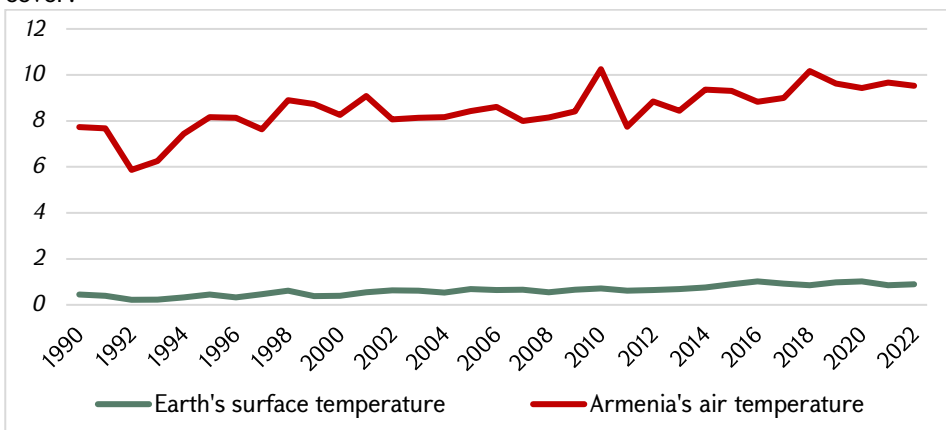


Figure 2. Armenia's air temperature¹³ and Earth's surface temperature (Celsius scale)¹⁴, 1990-2022

¹¹ The World Bank's Climate Change Knowledge Portal:

<https://climateknowledgeportal.worldbank.org/country/armenia/climate-data-historical>

¹² The World Bank data: <https://data.worldbank.org/indicator/EN.ATM.CO2E.KT?view=chart>

¹³ The World Bank data: <https://climateknowledgeportal.worldbank.org/country/armenia/climate-data-historical>

¹⁴ The National Aeronautics and Space Administration (NASA) data: <https://climate.nasa.gov/vital-signs/global-temperature/>

Annual precipitation in Armenia is relatively low, averaging 526 millimeters (mm). However, precipitation intensity is higher in high-altitude regions, with May and June being the wettest months. The records from the Statistical Committee of the Republic of Armenia indicate that the annual precipitation for 2023 reached 576.8 mm, while the average annual temperature was 7.7°C.

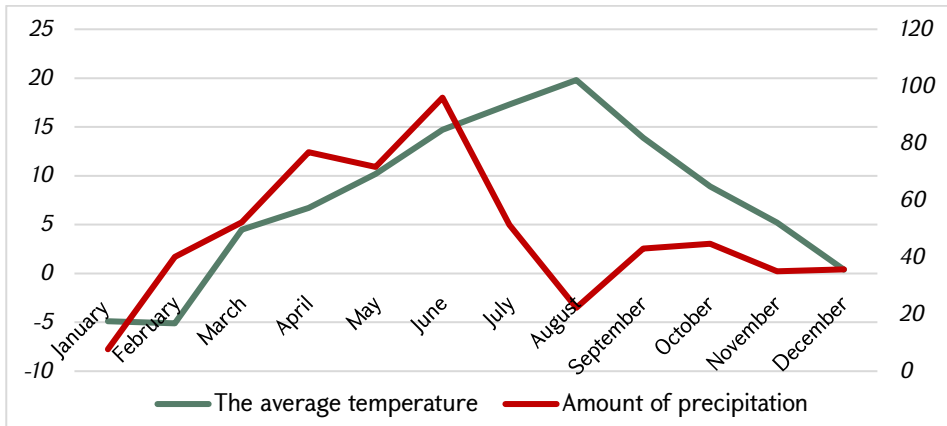


Figure 3. Values of average monthly temperatures and precipitation in RA, 2023¹⁵

Altitude plays a significant role in determining temperature and precipitation patterns, with sub-zero temperatures common in mountainous areas and higher precipitation levels in elevated regions. In contrast, the western plains experience higher average temperatures and lower precipitation levels, with some of the highest peaks receiving up to 1,000 mm of annual precipitation while the western plains may receive as little as 200 mm¹⁶.

Climate change, alongside other factors, poses significant threats to biodiversity. In Armenia, the impact of climate change on biodiversity is evident in the latest edition of the Red Book of Plants¹⁷, which identifies 452 species of high-quality plants. Alarmingly, 72 of these species are on the brink of extinction, highlighting the urgent need for conservation efforts to mitigate the adverse effects of climate change on Armenia's plant biodiversity.

Land degradation stands as one of the most severe consequences of climate change, particularly evident in Armenia where 77.4% of the territory faces the looming threat of desertification. This alarming statistic highlights the urgent need for concerted efforts to combat land degradation and preserve the remaining 22.6% of land that has not yet undergone desertification processes. Effective mitigation strategies and sustainable land management practices are essential to safeguard Armenia's precious land resources against the detrimental impacts of climate change.

¹⁵ The Statistical Committee of the Republic of Armenia, Socio-Economic Situation of RA, January-December 2023, Environment and Natural Resources, available at: https://armstat.am/file/article/sv_01_24a_580.pdf

¹⁶ The World Bank data: <https://climateknowledgeportal.worldbank.org/country/armenia/climate-data-historical>

¹⁷ Official website of the Ministry of Environment of The Republic of Armenia: <http://www.mnp.am/karmir-girq>

The pressure on forest ecosystems is intricately tied to climate change, leading to a rise in the frequency of forest fires and damaged areas. Additionally, instances of forest damage caused by pests have become more prevalent. Climate change contributes to these challenges by inducing shifts in forest ecosystems' vertical zonation, with an upward movement of 100-200 meters. Consequently, steppe plants are observed to encroach upon the lower reaches of forests. These changes underscore the urgent need for proactive measures to mitigate the impacts of climate change on forest ecosystems and enhance their resilience against such threats.

Climate change-induced drying of regions adversely affects agricultural yields, exacerbating food insecurity. Moreover, the frequency of heat waves, characterized by prolonged periods of daily temperatures exceeding 25 degrees Celsius for five consecutive days, is on the rise. These heat waves pose significant health risks, particularly for individuals with cardiovascular conditions. Furthermore, the escalation of extreme weather events, including floods, high winds, and droughts, compounds the challenges faced by communities. In recent years, agriculture has suffered significant losses attributed to frequent occurrences of hailstorms and spring frosts, further underscoring the detrimental impacts of climate change on agricultural productivity and livelihoods.

The Republic of Armenia's Fourth National Communication on Climate Change (NC4) was developed in compliance with Articles 4.1 and 12.1 of the United Nations Framework Convention on Climate Change (UNFCCC) and adheres to the Guidelines for National Communications of non-Annex I Parties to the Convention (2003). Building upon previous submissions, Armenia submitted its First National Communication (NC1) in 1998, covering the period of 1990-1996, followed by the Second National Communication (NC2) in 2010, covering 1996-2006, and the Third National Communication (NC3) in 2015, covering 2007-2012. According to NC4 over the past century, the country has experienced a significant increase in its average temperature, with temperatures rising by more than 1.2°C since 1929. These changing climatic patterns have triggered the degradation of vital landscapes, including watersheds and wetlands, posing serious challenges to Armenia's ecosystems and natural resources.

Given Armenia's agrarian economy and the prevalence of rural livelihoods, disruptions to agricultural activities due to climate-related events can have severe socio-economic consequences. These vulnerable populations often lack the resources and infrastructure necessary to adapt to changing climatic conditions, further exacerbating their susceptibility to climate-induced risks. Addressing the vulnerabilities of Armenia's rural population to climate change requires targeted interventions aimed at building resilience, enhancing adaptive capacities, and promoting sustainable livelihood practices. It is crucial to implement policies and initiatives that empower rural communities, improve access to resources and support mechanisms, and promote gender-inclusive approaches to climate resilience. By prioritizing the needs of vulnerable rural populations, Armenia can work towards achieving sustainable development and climate resilience across its agricultural sector.

In response to these challenges, Armenia has initiated a bold and ambitious endeavor to adapt to climate change and mitigate domestic greenhouse gas emissions, which exacerbate the climate crisis. Through strategic policies, innovative initiatives, and collaborative efforts, Armenia is working towards enhancing its resilience to climate impacts while simultaneously reducing its carbon footprint. This proactive approach underscores Armenia's commitment to addressing the pressing issues posed by climate change and underscores its determination to contribute to global efforts aimed at combating climate change.

To mitigate Armenia's vulnerability to climate change, it is imperative to enhance investments and integrate both climate change adaptation and disaster risk reduction measures. Recognizing this need, the Government of Armenia is actively mainstreaming and integrating climate crisis considerations into national and sectoral development policies.

In 2016, the Armenian government initiated the National Adaptation Plan (NAP) process, which included extensive national consultations and a comprehensive stocktaking exercise. This exercise provided a qualitative assessment of the institutional frameworks and capacities pertinent to the NAP process. By 2021, significant progress had been made – the National Adaptation Plan was officially adopted by Government Decision N749-L on May 13, 2021. Additionally, the updated Nationally Determined Contributions (NDCs) were adopted on April 22, 2021. These developments highlight Armenia's commitment to enhancing its climate adaptation strategies and meeting its international climate commitments.

Furthermore, with support from the Green Climate Fund, the Government of Armenia is currently developing a national plan for climate change adaptation. This initiative underscores Armenia's commitment to proactively address the challenges posed by climate change and strengthen its resilience against its adverse impacts.

The Government of Armenia has prioritized the integration of climate change considerations into national and sectoral development policies, with a focus on implementing energy-efficiency measures and promoting renewable energy sources. These efforts not only contribute to environmental sustainability but also align with economic and social objectives.

Key policy initiatives include the approval of the National Action Program of Adaptation to Climate Change and the adoption of updated Nationally Determined Contributions (NDCs) for 2021-2030 under the Paris Agreement¹⁸. The new NDCs set an ambitious mitigation target of reducing emissions by 40% below 1990 levels by 2030. To enhance coordination and decision-making processes related to climate issues, a special inter-agency council has been established within the government.

Central to Armenia's energy strategy is the transition to climate neutrality, which is integral to achieving energy independence, ensuring energy security, and fostering green growth. The long-term goal is to attain climate neutrality by the second half of this century, reflecting Armenia's dedication to sustainable development and combating climate change.

¹⁸ Official website of the Ministry of Environment of The Republic of Armenia:
<http://www.mnp.am/mijazgayin-hamagorcakcutyun/azgayi-zekuycner>

The Republic of Armenia's 2021–2030 Nationally Determined Contribution (NDC) to the Paris Agreement represents an updated version of its Intended Nationally Determined Contribution from 2015. The NDC outlines specific emission reduction targets to be achieved by 2030, with the overarching goal of attaining climate neutrality by the second half of the century. Oversight of the NDC implementation falls under the purview of the Ministry of Environment, which serves as the key governmental institution in this regard.

Aligned with the principles of a green economy, Armenia's NDC is designed to be compatible with the Sustainable Development Goals (SDGs), integrating climate action with broader social and economic development objectives. The document emphasizes the importance of national adaptation planning (NAP), aimed at mitigating climate risks, capitalizing on emerging opportunities, and enhancing resilience across various sectors. Adaptation activities outlined in the NDC span key sectors such as natural ecosystems, human health, water resource management, agriculture, energy, human settlements and infrastructure, and tourism.

The National Action Program of Adaptation to Climate Change and the List of Measures for 2021–2025 serve as the strategic framework for climate change adaptation in Armenia. Approved by the Government of Armenia, this program outlines efforts towards national adaptation planning and guides adaptation initiatives both presently and into the future. It represents Armenia's commitment to meeting its obligations under international climate change treaties while aligning with the Sustainable Development Goals (SDGs).

The NAP process in Armenia aims to mainstream climate change adaptation considerations across various sectors vulnerable to its impacts. These sectors include natural ecosystems, water resources, agriculture, energy, health, human settlements, and tourism. The overarching vision of the NAP process is to provide clarity, balance, and direction for effective adaptation action delivery. As part of this process, sectoral adaptation plans are currently under development and will be submitted to the Government for approval. Through coordinated efforts and strategic planning, Armenia endeavors to enhance its resilience to climate change and safeguard vulnerable sectors against its adverse effects.

Despite the challenges posed by climate change, Armenia also presents several opportunities for addressing and mitigating its impacts. Armenia has significant potential for renewable energy sources, including solar, wind, and hydropower. Investing in renewable energy infrastructure not only reduces greenhouse gas emissions but also enhances energy security and creates employment opportunities. Restoring degraded ecosystems, such as forests and wetlands, can help mitigate the impacts of climate change, enhance biodiversity, and provide valuable ecosystem services such as carbon sequestration and water regulation. Implementing climate-smart agricultural practices, such as conservation agriculture and agroforestry, can increase resilience to climate change, improve soil health, and enhance food security. Efficient water resource management practices, including rainwater harvesting, groundwater recharge, and water conservation measures, can help alleviate water scarcity and ensure sustainable water supply for agriculture, industry, and domestic use. Investing in

climate-resilient infrastructure, such as flood defenses, stormwater management systems, and green infrastructure, can reduce the vulnerability of communities to extreme weather events and enhance overall resilience. Engaging local communities in climate adaptation and mitigation efforts and building their capacity to cope with climate-related risks can foster social cohesion, empower vulnerable groups, and enhance adaptive capacity. Collaborating with international partners, accessing climate finance mechanisms, and leveraging technology transfer opportunities can support Armenia's efforts to address climate change effectively and achieve sustainable development goals. By capitalizing on these opportunities and implementing targeted policy interventions, Armenia can not only address the challenges posed by climate change but also unlock pathways towards a more resilient, sustainable, and prosperous future.

In conclusion, while the initiatives for reforestation and forest protection in Armenia are commendable, they currently lack comprehensive monitoring systems that could evaluate the long-term survival and growth of newly planted areas. Additionally, community involvement in these projects is often limited, which can hinder local support and sustainability. To enhance the effectiveness of forest restoration efforts, it is essential to develop community-driven forest management programs that not only focus on planting trees but also on managing forest health, preventing fires, and fostering biodiversity. Armenia's efforts to improve water efficiency in agriculture through the introduction of drip irrigation systems are a positive step toward adaptation. However, the adoption rate is slow due to high initial costs and a lack of awareness among farmers about the long-term benefits. The government should consider subsidizing the cost of modern irrigation technologies and running extensive educational campaigns to demonstrate the economic and environmental benefits of such systems to farmers. Armenia has made significant strides in developing its renewable energy sector, particularly solar energy. However, the integration of renewable sources into the national grid poses technical challenges, and the absence of sufficient storage solutions limits the potential for scaling up. Investing in research and development for energy storage technologies and enhancing grid infrastructure are crucial steps to maximize the penetration of renewables in Armenia's energy mix. The initiatives to increase energy efficiency in residential and commercial buildings are progressing, but the retrofitting rates are below the targets set by national policies. This slow progress can be attributed to the lack of incentives for property owners and inadequate information on the benefits of energy efficiency. Implementing more aggressive incentive programs, such as tax reductions or rebates for energy-efficient renovations, could accelerate the adoption of energy-saving measures in buildings. While Armenia has established numerous policies to combat climate change, there is a need for better alignment and integration of these policies across different sectors. A holistic approach that encompasses economic, environmental, and social aspects will be more effective in achieving the broader goals of sustainable development and climate resilience. Armenia should focus on leveraging advanced technologies and innovations, such as artificial intelligence and big data, to predict climate impacts more accurately and enhance decision-making processes in climate policies. Enhancing public awareness and involvement

in climate action is imperative. Educational programs that focus on the impacts of climate change and the importance of individual and collective action can empower citizens and foster a culture of sustainability.

CONCLUSIONS: In conclusion, Armenia stands at a pivotal juncture in its response to climate change, where challenges intersect with opportunities to shape a resilient and sustainable future. While the country faces daunting climate-related risks, ranging from temperature increases to biodiversity loss and water scarcity, proactive measures and policy responses offer avenues for effective adaptation and mitigation.

Armenia's rich potential in renewable energy sources, including solar, wind, and hydropower, presents a significant opportunity to transition towards a low-carbon economy. Investing in renewable energy infrastructure not only reduces greenhouse gas emissions but also enhances energy security and creates employment opportunities, contributing to economic growth and resilience.

Moreover, restoring degraded ecosystems, such as forests and wetlands, holds promise for mitigating the impacts of climate change and enhancing biodiversity. These ecosystems provide valuable ecosystem services, including carbon sequestration and water regulation, which are crucial for climate resilience and sustainable development.

Implementing climate-smart agricultural practices, such as conservation agriculture and agroforestry, can bolster food security, improve soil health, and increase resilience to climate change impacts. Efficient water resource management practices, including rainwater harvesting and groundwater recharge, are essential for alleviating water scarcity and ensuring sustainable water supply for agriculture, industry, and domestic use.

Investing in climate-resilient infrastructure, such as flood defenses and stormwater management systems, is critical for reducing the vulnerability of communities to extreme weather events and enhancing overall resilience. Furthermore, engaging local communities in climate adaptation and mitigation efforts, building their capacity to cope with climate-related risks, and promoting social cohesion are vital for fostering resilience and inclusive development.

International collaboration, accessing climate finance mechanisms, and leveraging technology transfer opportunities can support Armenia's efforts to address climate change effectively. By capitalizing on these opportunities and implementing targeted policy interventions, Armenia can not only address the challenges posed by climate change but also unlock pathways towards a more resilient, sustainable, and prosperous future for its citizens and the planet.

The Republic of Armenia's commitment to integrating climate considerations into national and sectoral development policies, evidenced by initiatives such as the National Action Program of Adaptation to Climate Change and the updated Nationally Determined Contributions (NDCs), reflects a proactive stance towards climate action. Through collaborative efforts and strategic planning, Armenia can navigate the challenges posed by climate change and pave the way towards a more resilient, sustainable, and prosperous future for its citizens and the planet.

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ՏԱԹԵՎԻԿ ՎԱՐԴԱՆՅԱՆ

ՀՊՏՀ միջազգային տնտեսական հարաբերությունների ամբիոնի դասախոս, տնտեսագիտության թեկնածու

Հայաստանում կլիմայի փոփոխության հետևանքների գնահատումը. մարտահրավերներ, հնարավորություններ և քաղաքականության արձագանքներ.– Հարավային Կովկասում գտնվող Հայաստանը բախվում է կլիմայի փոփոխության հետևանքով առաջացած լուրջ մարտահրավերների, այդ թվում՝ ջերմաստիճանի բարձրացում, տեղումների մակարդակի փոփոխություն և եղանակային ծայրահեղ դրսևորումների հաճախականության աճ: Մյուս կողմից՝ այս մարտահրավերների համար անհրաժեշտ է ստեղծել պրոակտիվ հարմարվողականության և մեղմացման ջանքերի հնարավորություններ: Վերականգնվող էներգիայի զարգացումը, էկոհամակարգերի վերականգնումը, կլիմայական համատեքստում «խելացի» գյուղատնտեսությունը, ջրի արդյունավետ կառավարումը, կլիմայի դիմացկուն ենթակառուցվածքները, համայնքի ներգրավվածությունը, կարողությունների զարգացումը և միջազգային համագործակցությունը հնարավորություն են տալիս արդյունավետորեն լուծելու կլիմայի փոփոխության ազդեցությունը: Օգտագործելով այս հնարավորությունները և իրականացնելով նպատակային քաղաքականության միջոցառումներ՝ Հայաստանը կարող է ամրապնդել իր ճկունությունը, նպաստել կայուն զարգացմանը և մեղմել կլիմայի փոփոխության բացասական ազդեցությունը: Հոդվածը գնահատում է կլիմայի փոփոխության ազդեցությունը Հայաստանում, ուրվագծում հիմնական մարտահրավերներն ու հնարավորությունները և նախանշում է քաղաքական միջոցառումներ՝ ուղղված կլիմայի ճկունության և կայունության բարելավմանը:

Հիմնաբառեր. *Հայաստան, կլիմայի փոփոխություն, ջերմոցային գազերի արտանետումներ, հարմարվողականություն, մեղմացում, խոցելիություն, քաղաքականության արձագանքներ*
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Оценка последствий изменения климата в Армении: вызовы, возможности и политические ответы.— Армения, расположенная на Южном Кавказе, сталкивается с серьезными проблемами, вызванными изменением климата, включая повышение температуры, изменение режима осадков и увеличение частоты экстремальных погодных явлений. Однако среди этих проблем скрываются возможности для активной адаптации и усилий по смягчению последствий. Развитие возобновляемых источников энергии, восстановление экосистем, климатически оптимизированное сельское хозяйство, эффективное управление водными ресурсами, климатически устойчивая инфраструктура, вовлечение сообществ, наращивание потенциала и международное сотрудничество открывают возможности для эффективного решения последствий изменения климата. Используя эти возможности и реализуя целенаправленные политические меры, Армения может повысить свою устойчивость, способствовать устойчивому развитию и смягчить неблагоприятные последствия изменения климата. В данной статье оцениваются последствия изменения климата в Армении, обрисовываются ключевые проблемы и возможности, а также излагаются политические меры, направленные на повышение устойчивости и устойчивости климата.

Ключевые слова: Армения, изменение климата, выбросы парниковых газов, адаптация, смягчение последствий, уязвимость, политические меры реагирования.

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